Hydrological Processes 2013 vol.27 N6, pages 807-821

Using Chernobyl-derived 137Cs to document recent sediment deposition rates on the River Plava floodplain (Central European Russia)

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Abstract

Floodplain sedimentation is one of the most dynamic geomorphic processes within plain and lowland landscapes. There is generally a good understanding of longer term floodplain evolution, but quantitative information on overbank deposition rates for recent shorter timescales is lacking. This paper describes the application of Chernobyl-derived 137Cs to quantify floodplain aggradation rates for the River Plava (a small river draining a severely contaminated part of the upland region of Central European Russia), based on detailed sampling of four representative floodplain study sites. Two approaches have been employed for estimating post-Chernobyl (1986-2009) floodplain accumulation rates. The first was based simply on locating the Chernobyl fallout-associated 137Cs peak in overbank sediment sections. The second involved quantification of the increase in the total 137Cs inventory at individual sampling points associated with the post-Chernobyl deposition of contaminated suspended sediment. It has been shown that considerable local-scale variability of overbank deposition rates exists, with aggradation rates on the low level floodplain (6±1.2-14±2.8 mm year-1) exceeding by 1.5-3 times the values for the middle level floodplain (2±0.4-9±1.8 mm year-1) and by 3-6 times the values for the upper level floodplain (1±0.2-5±1.0 mm year-1) floodplain levels. Combining these estimates with information on the areas occupied by different floodplain levels within the 54 km long valley section, derived from detailed geomorphic surveys of the selected reaches, it has been estimated that about 9700±1950 t of sediment have been stored on floodplain during the 1986-2009 period. The role of floodplain storage in the overall basin sediment budget and conveyance losses within the main channel system have been evaluated.

http://dx.doi.org/10.1002/hyp.9461

Keywords

Chernobyl-derived 137Cs, European Russia, Floodplain development, Overbank sedimentation, Small rivers